

FORM PTO-1390 (M-10-95)		U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE		ATTORNEY'S DOCKET NUMBER
				1707
		TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371		U.S. APPLICATION NO. (IF KNOWN, SEE 37 CFR <b>09/890199</b>
INTERNATIONAL APPLICATION NO. <b>PCT/DE 00/04019</b>		INTERNATIONAL FILING DATE <b>NOVEMBER 11, 2000</b>		PRIORITY DATE CLAIMED <b>NOVEMBER 29, 2001</b>
TITLE OF INVENTION <b>SPUR-TOOTHED WHEEL FOR A WORM GEAR AND A FORM FOR PRODUCING SUCH A SPUR-TOOTHED GEAR</b>				
APPLICANT(S) FOR DO/EO/US <b>Walter HAUSSECKER, Rudolf STRAUB, Frank MOSKOB, Werner ERNST, Rudolf AUER, Michael BAUSER, Hans MATTES</b>				
Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:				
<ol style="list-style-type: none"> <li><input checked="" type="checkbox"/> This is a <b>FIRST</b> submission of items concerning a filing under 35 U.S.C. 371.</li> <li><input type="checkbox"/> This is a <b>SECOND</b> or <b>SUBSEQUENT</b> submission of items concerning a filing under 35 U.S.C. 371.</li> <li><input type="checkbox"/> This is an express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39(1).</li> <li><input type="checkbox"/> A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.</li> <li><input checked="" type="checkbox"/> A copy of the International Application as filed (35 U.S.C. 371 (c) (2))           <ol style="list-style-type: none"> <li><input type="checkbox"/> is transmitted herewith (required only if not transmitted by the International Bureau).</li> <li><input checked="" type="checkbox"/> has been transmitted by the International Bureau.</li> <li><input type="checkbox"/> is not required, as the application was filed in the United States Receiving Office (RO/US).</li> </ol> </li> <li><input checked="" type="checkbox"/> A translation of the International Application into English (35 U.S.C. 371(c)(2)).</li> <li><input type="checkbox"/> A copy of the International Search Report (PCT/ISA/210).</li> <li><input type="checkbox"/> Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371 (c)(3))           <ol style="list-style-type: none"> <li><input type="checkbox"/> are transmitted herewith (required only if not transmitted by the International Bureau).</li> <li><input type="checkbox"/> have been transmitted by the International Bureau.</li> <li><input type="checkbox"/> have not been made; however, the time limit for making such amendments has NOT expired.</li> <li><input type="checkbox"/> have not been made and will not be made.</li> </ol> </li> <li><input type="checkbox"/> A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).</li> <li><input checked="" type="checkbox"/> An oath or declaration of the inventor(s) (35 U.S.C. 371 (c)(4)).</li> <li><input type="checkbox"/> A copy of the International Preliminary Examination Report (PCT/IPEA/409).</li> <li><input type="checkbox"/> A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371 (c)(5)).</li> </ol>				
Items 13 to 18 below concern document(s) or information included:				
<ol style="list-style-type: none"> <li><input checked="" type="checkbox"/> An Information Disclosure Statement under 37 CFR 1.97 and 1.98.</li> <li><input type="checkbox"/> An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.</li> <li><input checked="" type="checkbox"/> A <b>FIRST</b> preliminary amendment. <b>A SECOND or SUBSEQUENT</b> preliminary amendment.</li> <li><input type="checkbox"/> A substitute specification.</li> <li><input type="checkbox"/> A change of power of attorney and/or address letter.</li> <li><input checked="" type="checkbox"/> Certificate of Mailing by Express Mail</li> <li><input type="checkbox"/> Other items or information:</li> </ol>				
				

U.S. APPLICATION NO. (IF KNOWN, SEE 37 CFR <b>09/890199</b>	INTERNATIONAL APPLICATION NO. <b>PCT/DE 00/04019</b>	ATTORNEY'S DOCKET NUMBER <b>1707</b>
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20. The following fees are submitted.:

**BASIC NATIONAL FEE (37 CFR 1.492 (a) (1) - (5)) :**

<input type="checkbox"/> Search Report has been prepared by the EPO or JPO .....	\$930.00
<input type="checkbox"/> International preliminary examination fee paid to USPTO (37 CFR 1.482) .....	\$720.00
<input type="checkbox"/> No international preliminary examination fee paid to USPTO (37 CFR 1.482) but international search fee paid to USPTO (37 CFR 1.445(a)(2)) .....	\$790.00
<input checked="" type="checkbox"/> Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO .....	\$1,070.00
<input type="checkbox"/> International preliminary examination fee paid to USPTO (37 CFR 1.482) and all claims satisfied provisions of PCT Article 33(2)-(4) .....	\$98.00

**CALCULATIONS PTO USE ONLY**

**\$1,000.00**

Surcharge of **\$130.00** for furnishing the oath or declaration later than  20  30 months from the earliest claimed priority date (37 CFR 1.492 (e)). **\$0.00**

CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE	
Total claims	11 - 20 =	0	x \$18.00	<b>\$0.00</b>
Independent claims	1 - 3 =	0	x \$80.00	<b>\$0.00</b>
Multiple Dependent Claims (check if applicable).			<input type="checkbox"/>	<b>\$0.00</b>

**TOTAL OF ABOVE CALCULATIONS = \$1,000.00**

Reduction of 1/2 for filing by small entity, if applicable. Verified Small Entity Statement must also be filed (Note 37 CFR 1.9, 1.27, 1.28) (check if applicable).  **\$0.00**

**SUBTOTAL = \$1,000.00**

Processing fee of **\$130.00** for furnishing the English translation later than  20  30 months from the earliest claimed priority date (37 CFR 1.492 (f)).  **\$0.00**

**TOTAL NATIONAL FEE = \$1,000.00**

Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31) (check if applicable).  **\$0.00**

**TOTAL FEES ENCLOSED = \$1,000.00**

Amount to be: refunded	\$
charged	\$

- A check in the amount of \_\_\_\_\_ to cover the above fees is enclosed.
- Please charge my Deposit Account No. **19-4675** in the amount of **\$1,000.00** to cover the above fees. A duplicate copy of this sheet is enclosed.
- The Commissioner is hereby authorized to charge any fees which may be required, or credit any overpayment to Deposit Account No. **19-4675** A duplicate copy of this sheet is enclosed.

**NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.**

SEND ALL CORRESPONDENCE TO:

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**SIGNATURE**

**MICHAEL J. STRIKER**

**NAME**

**27233**

**REGISTRATION NUMBER**

**JULY 26, 2001**

**DATE**

09/890199  
JC17 Rec'd PCT/PTO 26 JUL 2001

UNITED STATES PATENT AND TRADEMARK OFFICE

Examiner:                    Group:                    Attorney Docket # 1707

Applicant(s) : HAUSSECKER, W., E T AL

Serial No. :

Filed                    : Simultaneously

For                    : SPUR-TOOTHED WHEEL FOR A WORM GEAR  
AND A FORM FOR PRODUCING SUCH A SPUR-  
TOOTHED WHEEL

SIMULTANEOUS AMENDMENT

July 26, 2001

Honorable Commissioner of Patents and Trademarks  
Washington, D.C. 20231

SIRS:

Simultaneously with filing of the above identified application  
please amend the same as follows:

In the Claims:

Cancel all claims without prejudice.

Substitute the claims attached hereto.

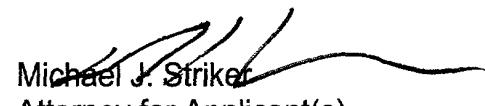
REMARKS:

This Amendment is submitted simultaneously with filing of the above identified application.

With the present Amendment applicant has amended the claims so as to eliminate their multiple dependency.

Consideration and allowance of the present application is most respectfully requested.

Respectfully submitted,

  
Michael J. Striker  
Attorney for Applicant(s)  
Reg. No. 27233

U.S. PATENT AND TRADEMARK OFFICE  
SEARCHED  
SERIALIZED  
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JULY 1 1997  
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U.S. PATENT AND TRADEMARK OFFICE  
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## Claims

1. Spur-toothed wheel for a worm gear having a first wheel disk (12) which carries teeth on a face that is cylindrical or designed in the shape of a truncated cone, characterized in that it has at least one second wheel disk (13, 14) which touches the first wheel disk (12) at a boundary surface (15) and which carries teeth on a face designed in the shape of a truncated cone, that the teeth of the two wheel disks continuously mesh into each other at the boundary surface (15), and that at least one of the two faces converges toward the boundary surface (15).

5

10

2. Spur-toothed wheel according to Claim 1, characterized in that the first wheel disk (12) is cylindrical.

15

15 3. Spur-toothed wheel according to Claim 1, characterized in that it has two second wheel disks (13, 14) on both sides of the first wheel disk (12).

4. Spur-toothed wheel according to [one of the preceding claims] Claim 1, characterized in that it is designed as a single piece.

20

5. Spur-toothed wheel according to [one of the preceding claims] Claim 1, characterized in that it is produced using an injection moulding procedure.

25

6. Form for producing a toothed wheel according to [one of the preceding claims] Claim 1, characterized in that it includes a tooth system insert (20) for the simultaneous shaping of the teeth of all wheel disks (12, 13, 14).

7. Form according to Claim 6, characterized in that the tooth system insert comprises multiple axial sections (21, 22, 26), each of which is complementary to a wheel disk.

30

8. Form according to Claim 6, characterized in that the tooth system insert extends as a single piece across the entire axial width of the teeth of all wheel disks.

5 9. Form according to Claim 8, characterized in that each tooth notch (24) of the tooth system insert (20, 20') is produced using a number of processing steps corresponding to the number of wheel disks (12, 13, 14) using an abrading tool (23), whereby the tooth system insert (20, 20') is tilted downward relative to the tool (23) between two processing steps.

10

10. Form according to [one of the Claims 6 through 9] Claim 6 for producing a toothed wheel according to Claim 2, characterized in that the tooth system insert (20) is designed as a single piece in the circumferential direction for removing the spur-toothed wheel from the mould in the axial direction.

15

11. Form according to [one of the Claims 6 through 9] Claim 6, characterized in that the tooth system insert (20') is divided into multiple segments (27) in the circumferential direction for removal from the mould in the radial direction.

Claims

1. Spur-toothed wheel for a worm gear having a first wheel disk (12) which carries teeth on a face that is cylindrical or designed in the shape of a truncated cone, characterized in that it has at least one second wheel disk (13, 14) which touches the first wheel disk (12) at a boundary surface (15) and which carries teeth on a face designed in the shape of a truncated cone, that the teeth of the two wheel disks continuously mesh into each other at the boundary surface (15), and that at least one of the two faces converges toward the boundary surface (15).

5

10

2. Spur-toothed wheel according to Claim 1, characterized in that the first wheel disk (12) is cylindrical.

15

3. Spur-toothed wheel according to Claim 1, characterized in that it has two second wheel disks (13, 14) on both sides of the first wheel disk (12).

4. Spur-toothed wheel according to Claim 1, characterized in that it is designed as a single piece.

20

5. Spur-toothed wheel according to Claim 1, characterized in that it is produced using an injection moulding procedure.

6. Form for producing a toothed wheel according to Claim 1, characterized in that it includes a tooth system insert (20) for the simultaneous shaping of the teeth of all wheel disks (12, 13, 14).

25

7. Form according to Claim 6, characterized in that the tooth system insert comprises multiple axial sections (21, 22, 26), each of which is complementary to a wheel disk.

30

8. Form according to Claim 6, characterized in that the tooth system insert extends as a single piece across the entire axial width of the teeth of all wheel disks.

5 9. Form according to Claim 8, characterized in that each tooth notch (24) of the tooth system insert (20, 20') is produced using a number of processing steps corresponding to the number of wheel disks (12, 13, 14) using an abrading tool (23), whereby the tooth system insert (20, 20') is tilted downward relative to the tool (23) between two processing steps.

10 10. Form according to Claim 6 for producing a toothed wheel according to Claim 2, characterized in that the tooth system insert (20) is designed as a single piece in the circumferential direction for removing the spur-toothed wheel from the mould in the axial direction.

15 11. Form according to Claim 6, characterized in that the tooth system insert (20') is divided into multiple segments (27) in the circumferential direction for removal from the mould in the radial direction.

(12) NACH DEM VERTRAG ÜBER DIE INTERNATIONALE ZUSAMMENARBEIT AUF DEM GEBIET DES  
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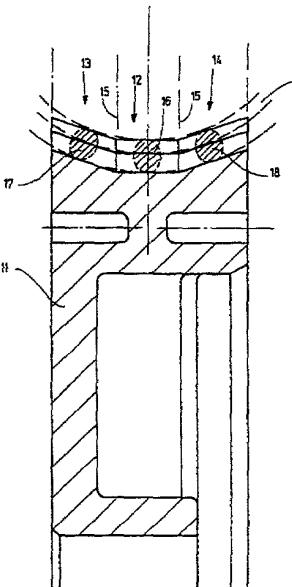
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[Fortsetzung auf der nächsten Seite]

(54) Title: SPUR PINION FOR A WORM GEAR AND AN EMBODIMENT FOR PRODUCING SUCH A WORM GEAR

(54) Bezeichnung: STIRNRAD FÜR EIN SCHNECKENGETRIEBE UND EINE FORM ZUR HERSTELLUNG EINES SOLCHEN STIRNRADS



**WO 01/40679 A2**

(57) Abstract: The invention relates to a spur pinion (11) for a worm gear. The inventive pinion is provided with at least two wheel discs (12, 13, 14) having a cylindrical or truncated front face. The wheel discs adjoin each other at a boundary surface (15). The teeth of the two adjacent wheel discs verge into each other in a continuous manner on said boundary surface. At least one of the front faces converges in the direction towards the boundary surface in such a way that the teeth of all the wheel discs can mesh with the same worm. The invention also relates to an embodiment for producing the inventive spur pinion.

[Fortsetzung auf der nächsten Seite]

# SPUR-TOOTHED WHEEL FOR A WORM GEAR AND A FORM FOR PRODUCING SUCH A SPUR-TOOTHED WHEEL

5 The present invention concerns a spur-toothed wheel for a worm gear and a form  
6 for producing such a spur-toothed wheel by way of injection moulding, for  
7 example.

Toothed wheels with helical gearing or globoidal or semi-globoidal toothed wheels are traditionally used as spur-toothed wheels for worm gears. While the tips of all teeth lie on a cylindrical surface in a simple toothed wheel having helical gearing, this surface in a globoidal toothed wheel has the shape of a concave circular arc in the axial profile. In a semi-globoidal toothed wheel, the cross section consists of a circular arc on which a straight line intercept touches it tangentially at the point closest to its axis.

17 Globoidal or semi-globoidal toothed wheels are used in applications in which the  
18 tooth system must have a high load-carrying capacity, because a globoidal tooth  
19 system can support a worm having a diameter adapted to the circular arc of the  
20 globoid practically along the entire width of the tooth system, and not only in a  
21 center section, as is the case with a simple helical gearing. The production of  
22 globoidal wheels is much more laborious than that of simple helically-toothed  
23 wheels, however, because, in order to work a single globoidal tooth out of a  
24 toothed wheel blank or the blank of a form, the position of the tool must be  
25 continuously adapted according to a complicated scheme as the processing  
26 progresses.

#### **Advantages of the Invention**

As a result of the present invention, a spur-toothed wheel for a worm gear is created, on the one hand, which has a greatly improved load-carrying capacity as

1 compared to a traditional toothed wheel having helical gearing and a cylindrical  
2 circumferential surface, the production of which is markedly simpler and less  
3 expensive than that of a globoidal wheel, however.

4

5 This is achieved in that, with a spur-toothed wheel for a worm gear which, in  
6 traditional fashion, has a first wheel disk having teeth on a cylindrical or conical  
7 face, at least one second wheel disk is added that touches the first wheel disk at  
8 a boundary surface and which carries teeth on a face designed in the shape of a  
9 truncated cone, whereby the teeth of the two wheel disks continuously mesh into  
10 each other at the boundary surface, and at least one of the two faces converges  
11 toward the boundary surface. In other words, one can conceive of designing the  
12 spur-toothed wheel according to the invention out of two wheel disks, of which at  
13 least one is designed in the shape of a truncated cone and the other is cylindrical  
14 or designed in the shape of a truncated cone, whereby at least one of the faces  
15 designed in the shape of a truncated cone is tapered toward the boundary  
16 surface. The constant meshing of the teeth of the two wheel disks is provided so  
17 that both wheel disks jointly mesh with the same worm and can thereby carry a  
18 load.

19

20 Preferably, two second wheel disks are provided on both sides of the first wheel  
21 disk, so that the tooth system can carry a load at three places altogether.

22

23 It is possible to produce each of the wheel disks individually and provide them  
24 with teeth and then combine the completed toothed wheel disks to form the spur-  
25 toothed wheel according to the invention. In this fashion, the spur-toothed wheel  
26 according to the invention can be produced out of metal using an abrading  
27 machining process, for example.

28

29 It is preferred that the spur-toothed wheel be designed as a single piece. Such a  
30 spur-toothed wheel can be produced inexpensively using a moulding process  
31 such as injection moulding, out of a hard plastic, for example.

1  
2 Object of the invention is therefore also a form for producing a spur-toothed  
3 wheel of the type described above which includes a tooth system insert for the  
4 simultaneous shaping of the teeth of all wheel disks.

5  
6 Such a tooth system insert can comprise multiple formed wheels, each of which  
7 is complementary to one wheel disk. It is also possible in advantageous fashion,  
8 however, that the tooth system insert extend as a single piece across the entire  
9 axial width of the teeth of all wheel disks. Such a form is particularly easy to  
10 produce in that a number of processing steps corresponding to the number of  
11 wheel disks is carried out for each tooth notch using an abrading tool, whereby  
12 the tooth system insert has been tilted downward relative to the tool in the plane  
13 of the tooth notch between two processing steps.

14  
15 The tooth system insert can be designed as a single piece in the circumferential  
16 direction. This makes it possible for a finished spur-toothed wheel to be removed  
17 from the mould using a helical motion. Such a form is suited to producing toothed  
18 wheels having two wheel disks, one of which is cylindrical.

19  
20 As an alternative, the tooth system insert can be divided into multiple segments  
21 in the circumferential direction in order to make it possible to remove a finished  
22 toothed wheel from the mould by removing the segments in the radial direction.

23  
24 Further features and advantages of the invention result from the following  
25 description of design examples with reference to the figures.

26  
27 Figures

28  
29 Figure 1 shows, highly diagrammed, two worm gears, one of which has a  
30 globoidal spur-toothed wheel, and the other of which has a helically-toothed spur-  
31 toothed wheel;

1 Figures 2 and 3 show an axial view of two variants of the spur-toothed wheel  
2 according to the invention;

4 Figure 4 shows two stages of the production of a tooth system insert;

5 Figure 5 shows the cross section of a tooth system insert according to a first  
6 design; and

7 Figure 6 shows a tooth system insert according to a second design, in top view  
8 and as a sectional drawing.

#### 12                                  Description of the Design Examples

13 In order to better illustrate the special nature of the present invention, Figure 1  
14 first shows two traditional worm gears, a gear 1 having a globoidal spur-toothed  
15 wheel 2 and a gear 2 having a simple, helically-toothed spur-toothed wheel 4,  
16 both of them in mesh with a worm 5. In the idealized illustration of Figure 1, the  
17 worm 5 can be seen in both cases in a top view along its axis, and the spur-  
18 toothed wheels 3, 4 are shown as a sectional detail view.

19 In a helically-toothed spur-toothed wheel 4, contact between the spur-toothed  
20 wheel and the worm 5 is possible only on a narrow area 7 lying approximately in  
21 center on the tooth 6. The surface on which the spur-toothed wheel and the  
22 worm touch each other at a given point in time travels up and down within the  
23 contact area 7 in the course of the rotation of the gear on the tooth 6. In an  
24 idealized gear having absolutely stiff wheels, this surface would be punctiform, in  
25 practical application, its expansion depends on the flexibility of the material of the  
26 wheels and its extent of wear. The surface load of the contact area 7 is relatively  
27 great here, and it can lead to a rapid wearing of the spur-toothed wheel 4,

1 particularly if it is manufactured out of an inexpensive yet moderately resistant  
2 material such as a plastic.

3  
4 In a globoidal spur-toothed wheel 3, in contrast, contact with the worm 5 at all  
5 times is not possible at one point, but rather along a line that travels over the  
6 entire contact area 8 shown in the illustration as a shaded area in the course of  
7 the rotation of the gear. The contact area is practically identical with the surface  
8 of a tooth of the spur-toothed wheel. The load and, therefore, the wear, is  
9 distributed evenly across the entire surface of the tooth.

10  
11 Figure 2 shows a first design example of a spur-toothed wheel 11 according to  
12 the invention in an axial half-sectional view. The shape of the associated worm 5  
13 is indicated by dashed lines. The spur-toothed wheel 11 can be understood as  
14 comprising three wheel disks 12, 13, 14. The wheel disk 12 has a cylindrical  
15 circumferential surface, those of the wheel disks 13, 14 are designed in the  
16 shape of a truncated cone, whereby each smaller base area of the truncated  
17 cone forms a boundary surface with the wheel disk 12. All three circumferential  
18 surfaces have a helical gearing, whereby each of the teeth of the individual wheel  
19 disks continuously mesh into each other at the boundary surfaces 15. The groove  
20 angles of the circumferential surfaces designed in the shape of a truncated cone  
21 are specified as a function of the diameter of the worm 5 in such a way that each  
22 of the teeth of all three wheel disks touch those of the worm in contact areas 16,  
23 17, 18. The contact surface is therefore increased three-fold as compared with  
24 that of the worm gear 2.

25  
26 If an even greater contact area is required, the number of wheel disks and,  
27 therefore, the contact areas, can also be made larger than three.

28  
29 Figure 3 shows a simplified variant of the spur-toothed wheel from Figure 2. The  
30 wheel disk 13 designed in the shape of a truncated cone is eliminated in this

1 variant; instead, the cylindrical wheel disk 12 is widened. This variant is  
2 advantageous in production, as will become clear later.

3

4 Basically, the spur-toothed wheels shown in Figures 2 and 3 can be produced  
5 directly as globoidal wheels via abrading processing of a blank. A particular  
6 advantage compared to a globoidal wheel, however, is that the wheels according  
7 to the invention are suited for production via moulding and can therefore be  
8 produced much less expensively. In order to produce the teeth via moulding, a  
9 tooth system insert is required which can form a permanent or removable  
10 component of a form, of an injection moulding form, for instance. Figure 4 shows  
11 a diagram of the production of such a tooth system insert 20. A metal ring is used  
12 as the form for the production of the insert 20, the inner circumferential surface of  
13 which has multiple, sequential sections in the axial direction, each corresponding  
14 to the wheel disks of the toothed wheel to be produced. The ring 20 shown in  
15 Figure 4 has two such sections 21, 22, which correspond to the circular disks 12  
16 and 14, respectively, of the spur-toothed wheel from Figure 3. In the production  
17 section illustrated in Part a of Figure 4, tooth notches 24 are created in the first  
18 section 21 using the electroerosion technique by way of a wire 23, each of which  
19 corresponds to teeth of the circular disk 12 of the toothed wheel to be produced.  
20 After the section 21 has been provided with tooth notches 24 all the way around  
21 in this fashion, the ring 20 is tilted downward relative to the wire 23, so that  
22 corresponding tooth notches can also be formed in the adjacent section 21 in  
23 extension of each of the tooth notches 24 of the section 21. This stage is  
24 illustrated in Part b of Figure 4. Every time a tooth notch 24 is completed on the  
25 section 21, the ring 20 can also be tilted, of course, in order to create the  
26 corresponding notch in the section 22. In this process, the orientation of the tilting  
27 axis and tilting angle is selected as a function of the dimensions of a worm in  
28 such a way that the teeth of both sections formed later by the tooth notches can  
29 mesh with the worm and carry a load.

30

1 Figure 5 shows the finished tooth system insert 20 installed in a shell 25 of an  
2 injection moulding form. The tooth system insert 20 can be permanently installed  
3 in the shell 25, since, in order to remove a toothed wheel produced therein from  
4 the mould, it suffices to rotate this around the axis 26 in order to cause the  
5 toothed wheel to detach from the form in an upward direction and come free.

6

7 If the tooth system insert for the production of a toothed wheel of the form shown  
8 in Figure 2 has two sections designed in the shape of a truncated cone as the  
9 section 22 from Figure 4, this simple method of removal from the mould is no  
10 longer possible.

11

12 Figure 6 shows such a tooth system insert 20' in a top view and as a sectional  
13 drawing. As one can easily imagine based on the sectional drawing, the second  
14 section 26 designed in the shape of a truncated cone prevents a finished toothed  
15 wheel from being screwed out of the insert in the axial direction. For this reason,  
16 the tooth system insert 20' is divided into multiple sectors 27 in the  
17 circumferential direction. The number of sectors can be greater than the four  
18 sectors shown in the figure; its number is specified as appropriate in such a way  
19 that a simple removal from the mould is possible by moving the sectors 27 off of  
20 the finished toothed wheel in the radial direction.



## Claims

3       1. Spur-toothed wheel for a worm gear having a first wheel disk (12) which  
4 carries teeth on a face that is cylindrical or designed in the shape of a truncated  
5 cone, characterized in that it has at least one second wheel disk (13, 14) which  
6 touches the first wheel disk (12) at a boundary surface (15) and which carries  
7 teeth on a face designed in the shape of a truncated cone, that the teeth of the  
8 two wheel disks continuously mesh into each other at the boundary surface (15),  
9 and that at least one of the two faces converges toward the boundary surface  
10 (15).

11  
12 2. Spur-toothed wheel according to Claim 1, characterized in that the first  
13 wheel disk (12) is cylindrical.

15 3. Spur-toothed wheel according to Claim 1, characterized in that it has two  
16 second wheel disks (13, 14) on both sides of the first wheel disk (12).

18 4. Spur-toothed wheel according to one of the preceding claims,  
19 characterized in that it is designed as a single piece.

21 5. Spur-toothed wheel according to one of the preceding claims,  
22 characterized in that it is produced using an injection moulding procedure.

24 6. Form for producing a toothed wheel according to one of the preceding  
25 claims, characterized in that it includes a tooth system insert (20) for the  
26 simultaneous shaping of the teeth of all wheel disks (12, 13, 14).

28 7. Form according to Claim 6, characterized in that the tooth system insert  
29 comprises multiple axial sections (21, 22, 26), each of which is complementary to  
30 a wheel disk.

31

1    8.    Form according to Claim 6, characterized in that the tooth system insert  
2    extends as a single piece across the entire axial width of the teeth of all wheel  
3    disks.

4

5    9.    Form according to Claim 8, characterized in that each tooth notch (24) of  
6    the tooth system insert (20, 20') is produced using a number of processing steps  
7    corresponding to the number of wheel disks (12, 13, 14) using an abrading tool  
8    (23), whereby the tooth system insert (20, 20') is tilted downward relative to the  
9    tool (23) between two processing steps.

10

11    10.   Form according to one of the Claims 6 through 9 for producing a toothed  
12    wheel according to Claim 2, characterized in that the tooth system insert (20) is  
13    designed as a single piece in the circumferential direction for removing the spur-  
14    toothed wheel from the mould in the axial direction.

15

16    11.   Form according to one of the Claims 6 through 9, characterized in that the  
17    tooth system insert (20') is divided into multiple segments (27) in the  
18    circumferential direction for removal from the mould in the radial direction.

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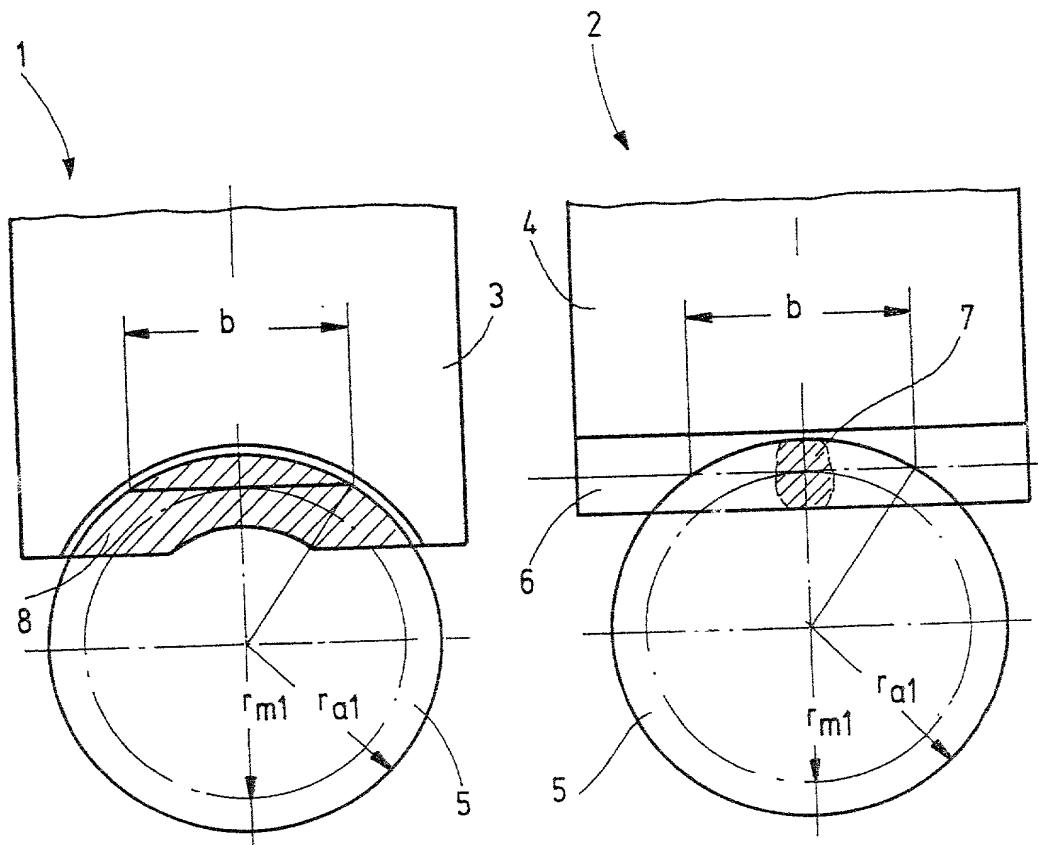


Fig.1

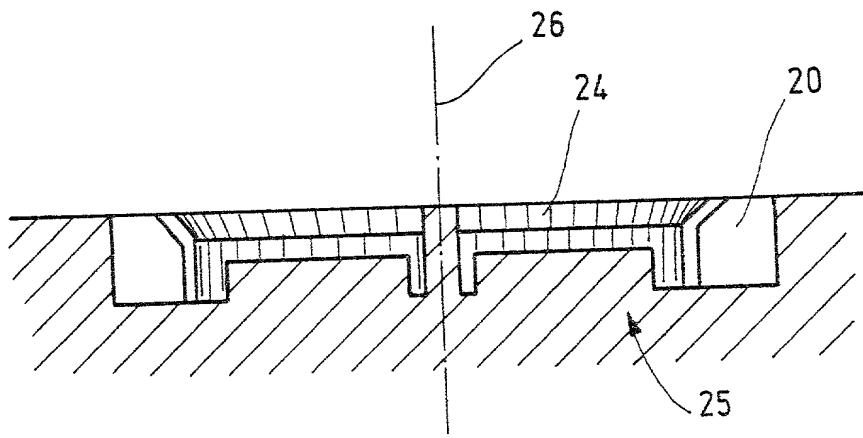


Fig.5

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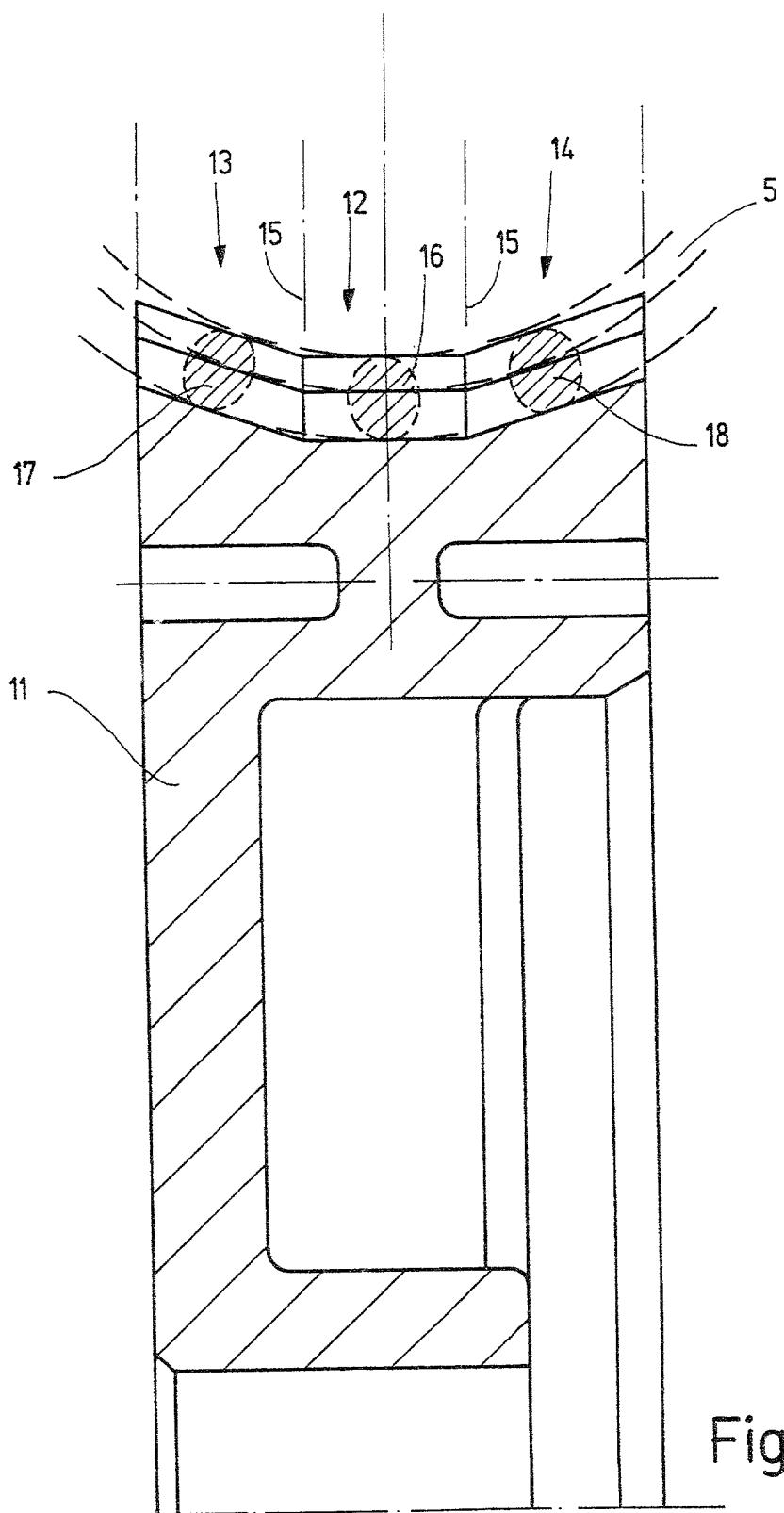


Fig. 2

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3 / 5

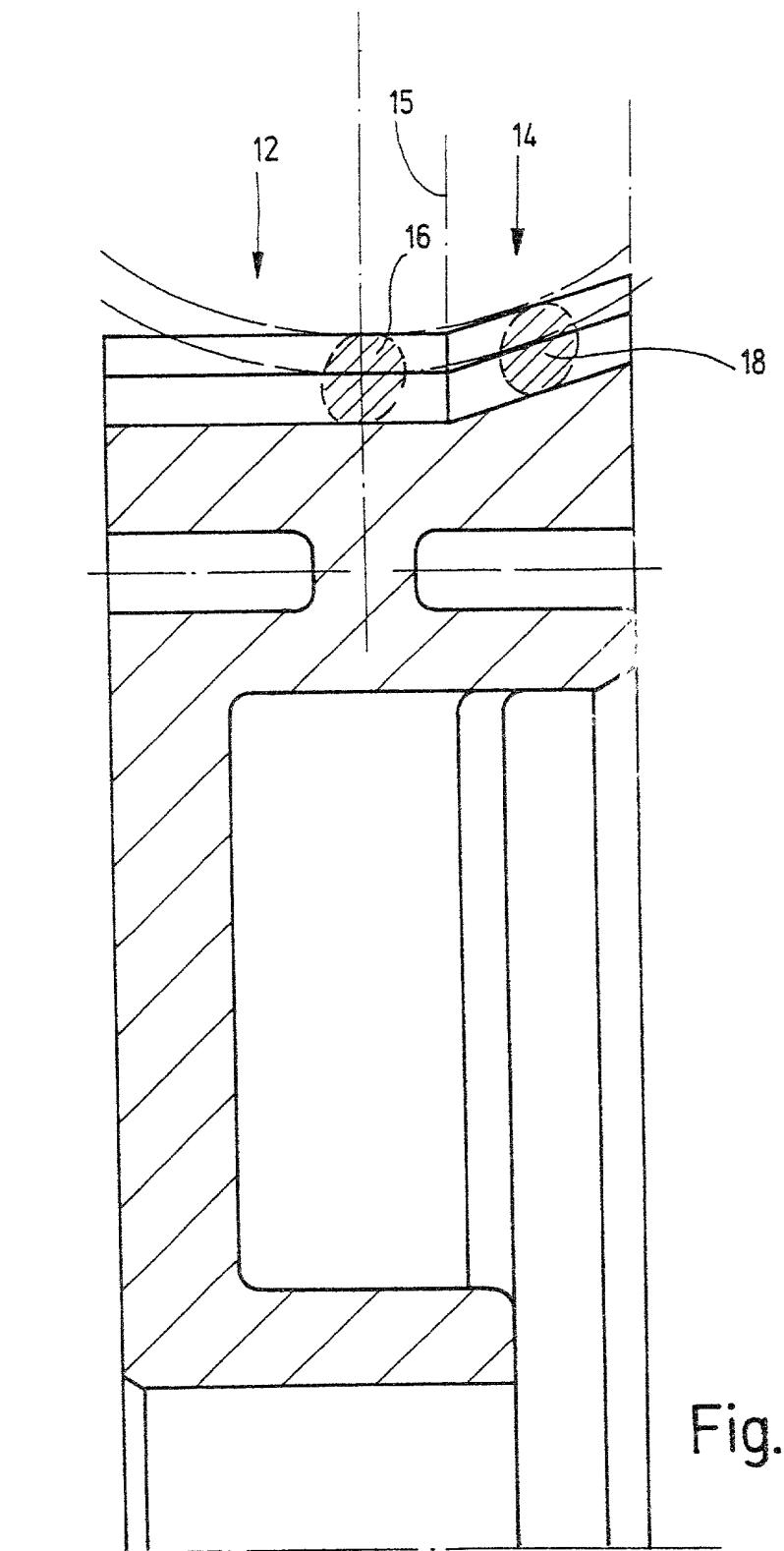
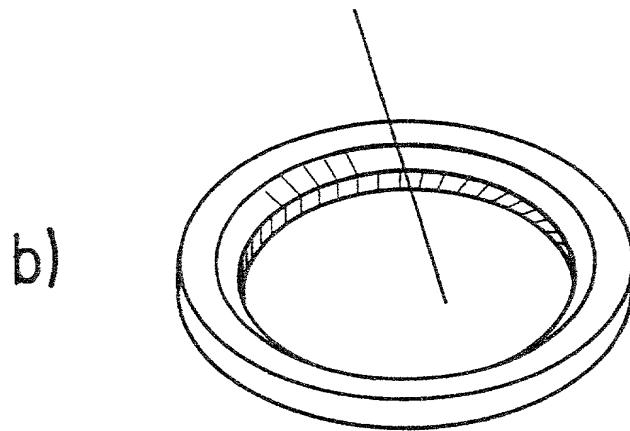
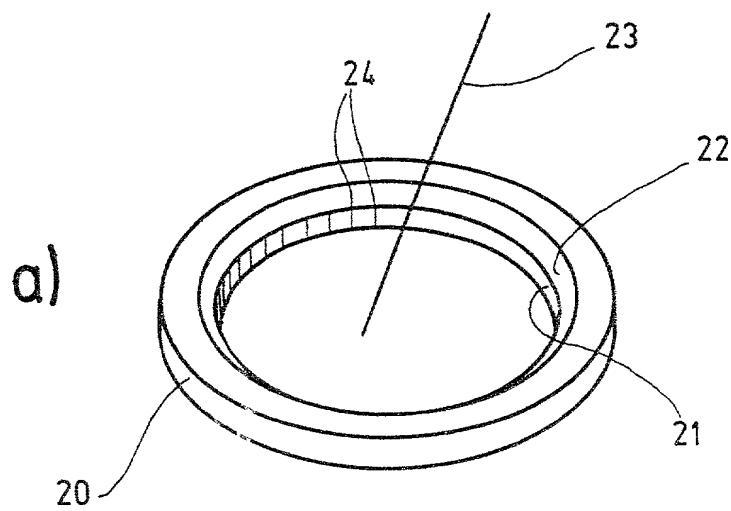


Fig.3

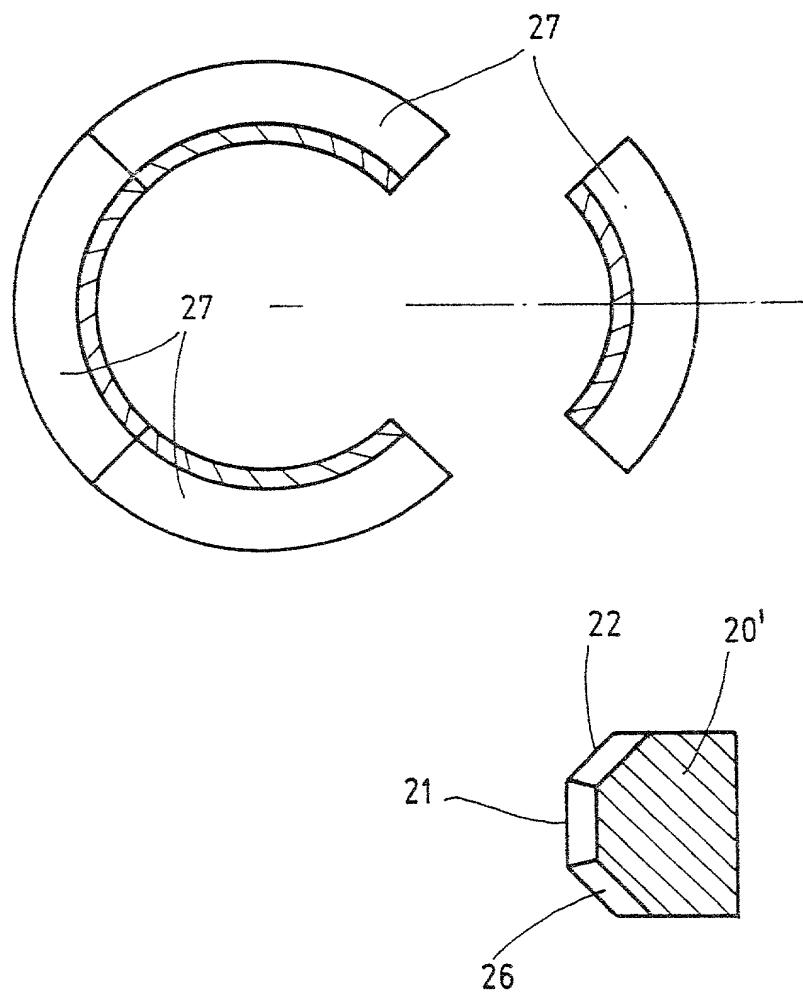
Fig.4



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5 / 5

Fig. 6



R. 37098

**DECLARATION AND POWER OF ATTORNEY FOR NATIONAL STAGE OF PCT PATENT APPLICATION**

As a below-named inventor, I hereby declare that:

Walter HAUSSECKER	Rudolf AUER
Rudolf STRAUB	Michael BAUSER
Frank MOSKOB	Hans MATTES
Werner ERNST	

My residence, post office address and citizenship are as stated below next to my name.

I believe I am the original, first and sole inventor (if only name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled **SPUR-TOOTHED WHEEL FOR A WORM GEAR AND A FORM FOR PRODUCING SUCH A SPUR-TOOTHED WHEEL** the specification of which was filed as PCT International Application number PCT/DE 00/04019 on November 11, 2000.

I hereby state that I believe the named inventor or inventors in this Declaration to be the original and first inventor or inventors of the subject matter which is claimed and for which a patent is sought.

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose all information which is material to the patentability of this application in accordance with Title 37, Code of Federal Regulations, Section 1.56.

I hereby claim foreign priority benefits under Title 35, United States Code, Section 119(a)-(d) or Section 365 (b) of any foreign application(s) for patent or inventor's certificate, or Section 365(a) of any PCT International application which designated at least one country other than the United States, listed below and have also identified below, by checking the box, any foreign application for patent or inventor's certificate or PCT International application having a filing date before that of the application on which priority is claimed.

Prior foreign application(s):

Priority claimed:

199 57 440.5 (Number)	GERMANY (Country)	NOVEMBER 29, 1999 (Date filed)	X Yes	<input type="checkbox"/> No
 (Number)	 (Country)	 (Date filed)	 Yes	 No

As a named inventor, I hereby appoint the following attorney to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith:

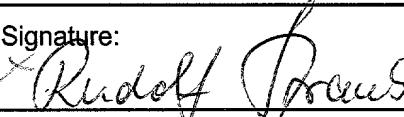
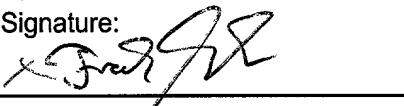
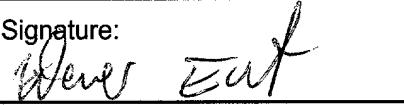
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I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with

the knowledge that wilful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such wilful false statement may jeopardize the validity of the application or any patent issued thereon.

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